Poynting

Making wireless happen

Marine LTE & 5G Connectivity

Waves

Making Out At Sea

^

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Agenda

Choosing the right antenna

Importance of antenna patterns & beamwidth

Antenna installation / separation tips

Antenna overview

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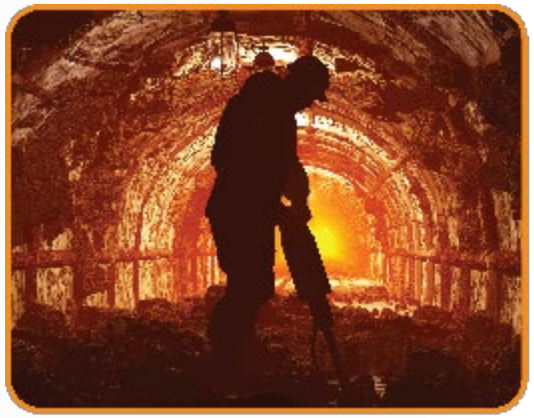
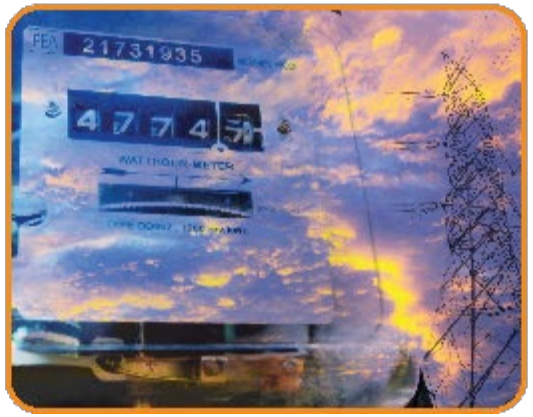
Poynting Antennas - Verticals





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Mobility & Transportation **Internet of Things** **Wireless Broadband** **Smart Cities**

Industrial Automation **Private & Business** **Security & Remote Monitoring**

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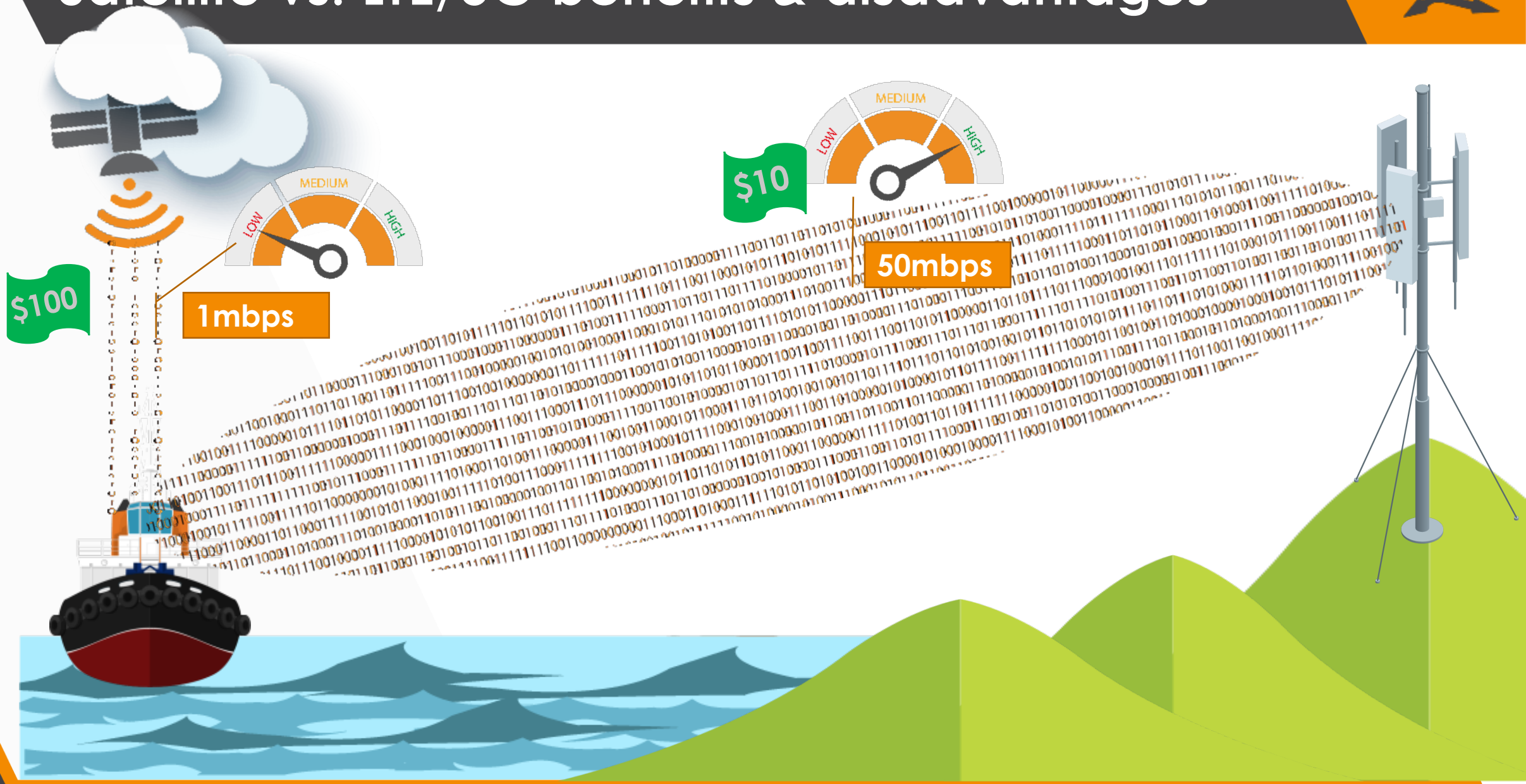
Satellite vs. LTE/5G benefits & disadvantages



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Satellite Only Scenario

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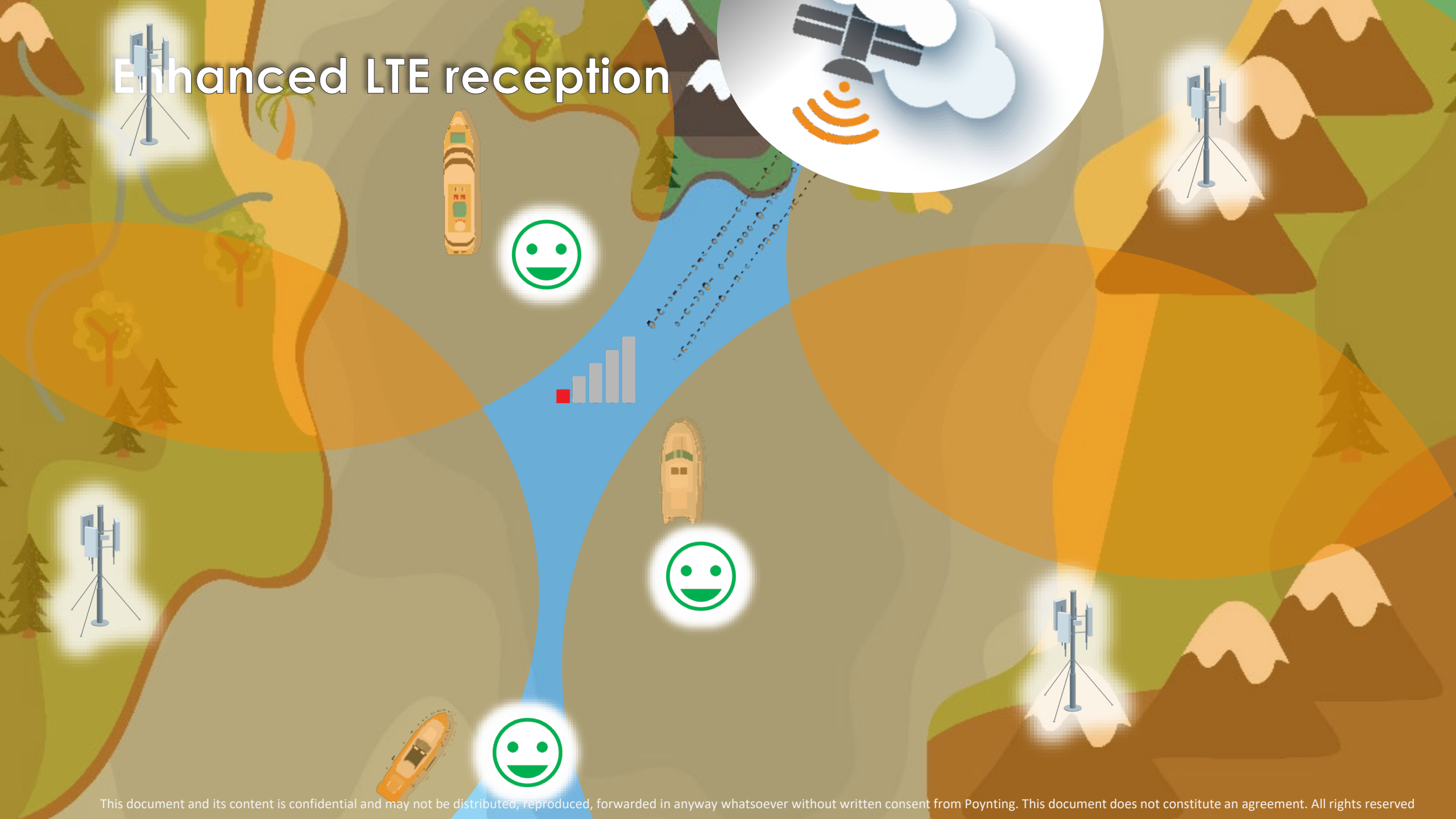
Enhanced LTE reception



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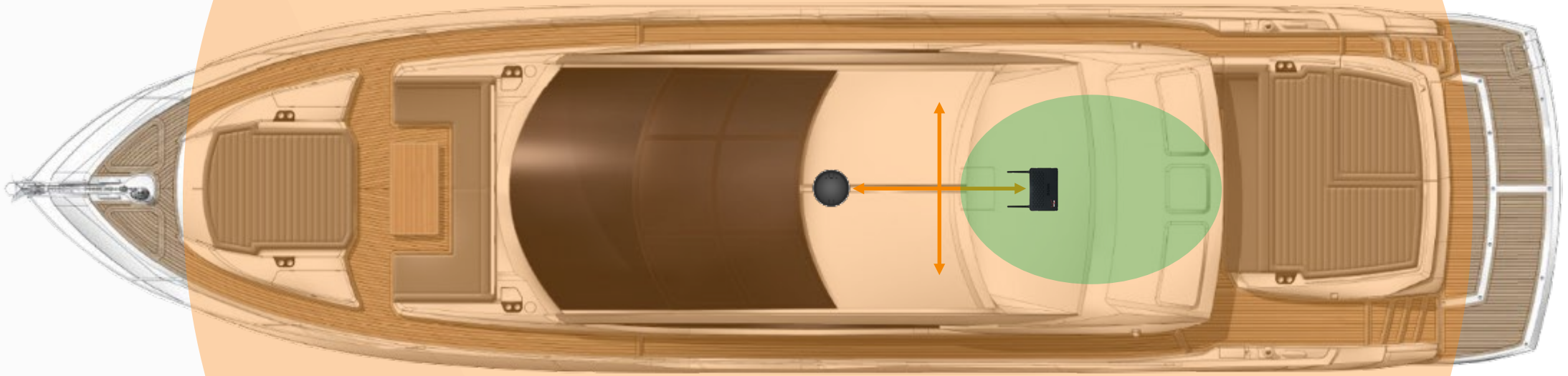
Integrated AP antennas vs. external WiFi distribution?



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Choosing the correct antenna

Initial considerations for choosing the applicable antenna:

(Other technical aspects also to be considered, see the detailed specification sheets)

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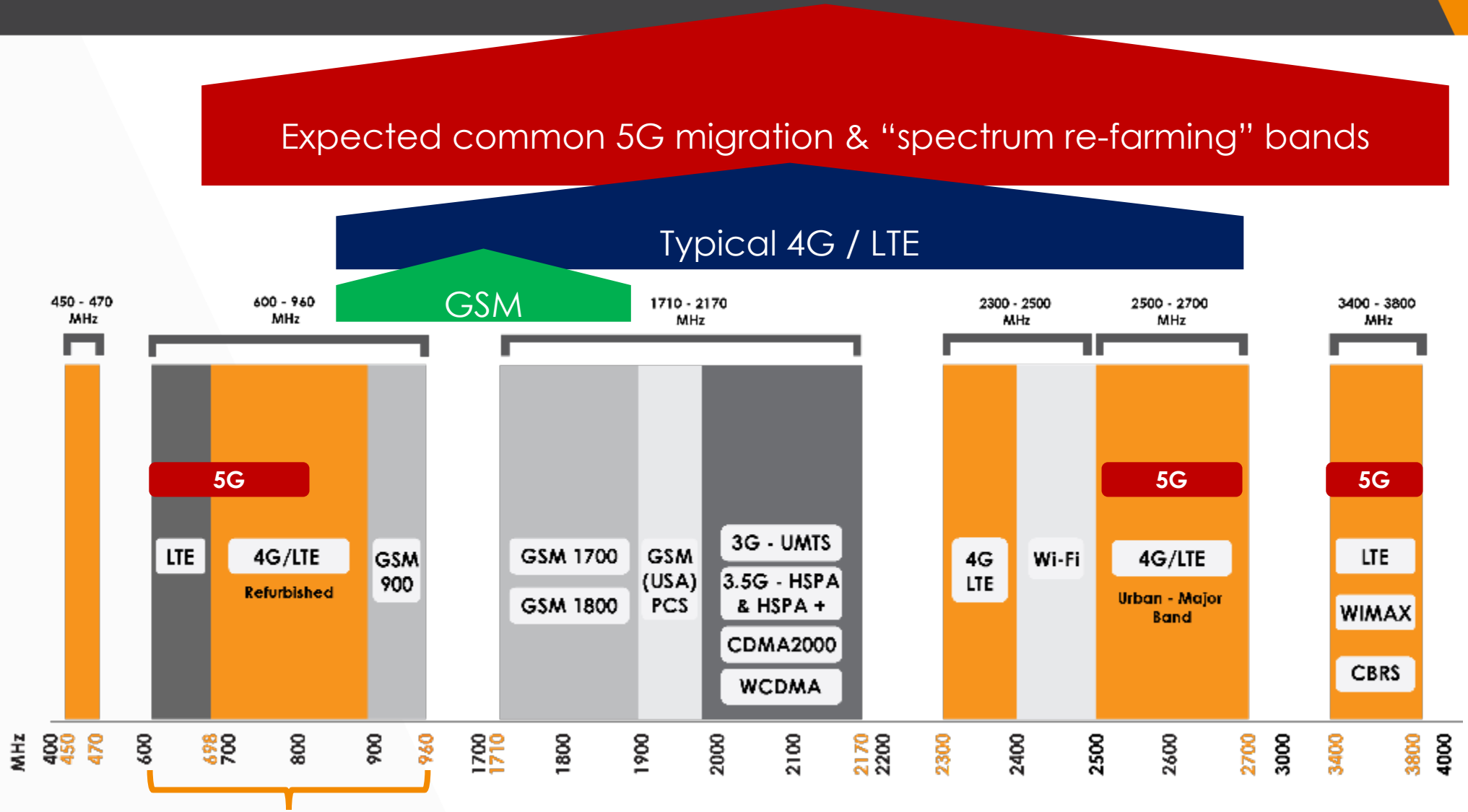
Overview of more common Cellular Bands



Preferred Marine bands due to path loss, but what about Freznel effect?

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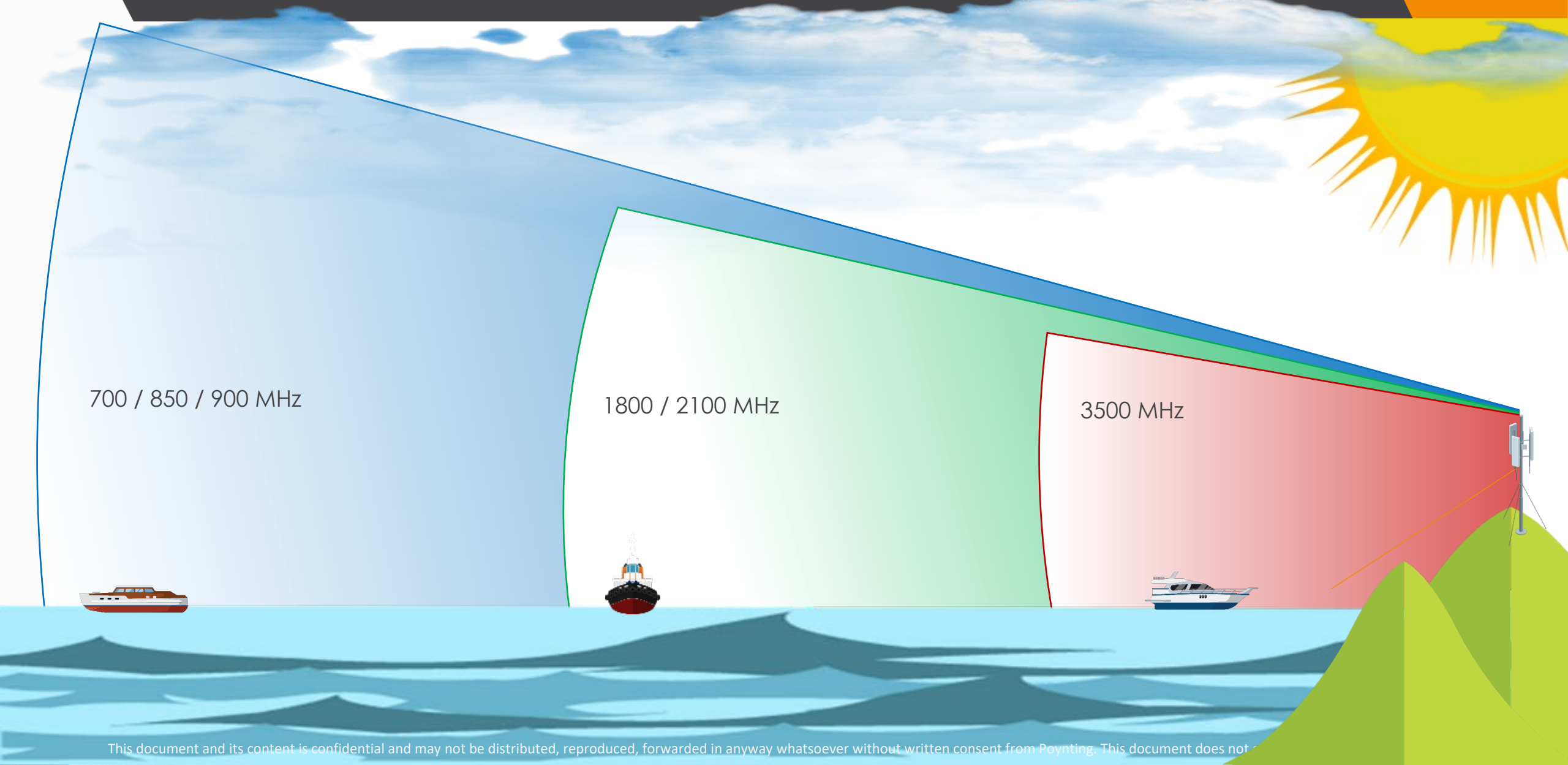
RF Propagation: Frequency Bands vs Distance



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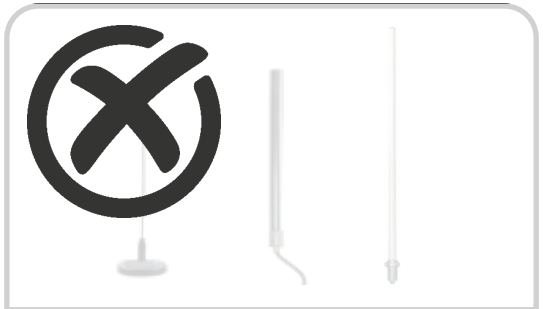
Omni Antennas – for LTE / 5G

			
Type	Simple 'cheap' wire Omni	Linear Wideband Omni	Low Profile Antenna
Visually	"Thin" rubber or wire antenna	Thicker Antenna Diameter	Low height, flat antenna
Bandwidth	Narrow Frequency Band	Wide Frequency Band	Medium to Wide Frequency Band
Future Proof	Low	High	High
Ruggedness & vandal proof	Low	Medium	High
Performance (Pattern, Gain, Etc.)	Medium (Elevation Pattern Breakup)	High	Medium
One product for many technologies & bands	Low	High	High

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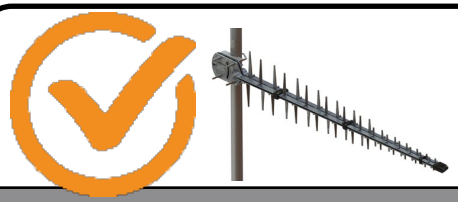
LPDA vs. Yagi Antenna vs. Panel Antenna for LTE / 5G

			
Type	Yagi-Uda (aka Yagi)	Log Periodic Dipole Array (aka LPDA)	Panel
Visually	Driven element with reflector & radiators	Array of elements with different lengths	Rectangular, flat & unobtrusive
Bandwidth	Narrow Frequency Band	Widest Frequency Band	Frequency Band depends on design
Future Proof	Low	High	High
Reliability	Medium to High	High	Medium to High
Performance (Pattern, Gain, Etc.)	High	High	High
One product for many technologies & bands	Low	High	Medium to High
MIMO	Requires Additional Antenna	Requires Additional Antenna	Integrated 2x2, 4x4, etc.

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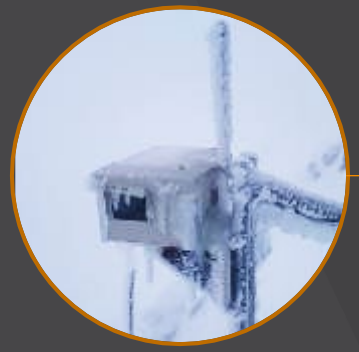
Environmental Considerations (incl. RoHS)

Wind
Designed to withstand160Km wind speeds and MORE

Extreme Conditions
Properties invisible to customers but cause failures much later. Need to use reputable manufacturer!



Rain, Ice & Snow
Operation & survival in extreme weather

Sun
UV protection so enclosure does not become brittle

Rust & Corrosion
Designed for salt water spray (OMNI-291 is salt-water protected)

Quality
High quality design, materials and manufacturing

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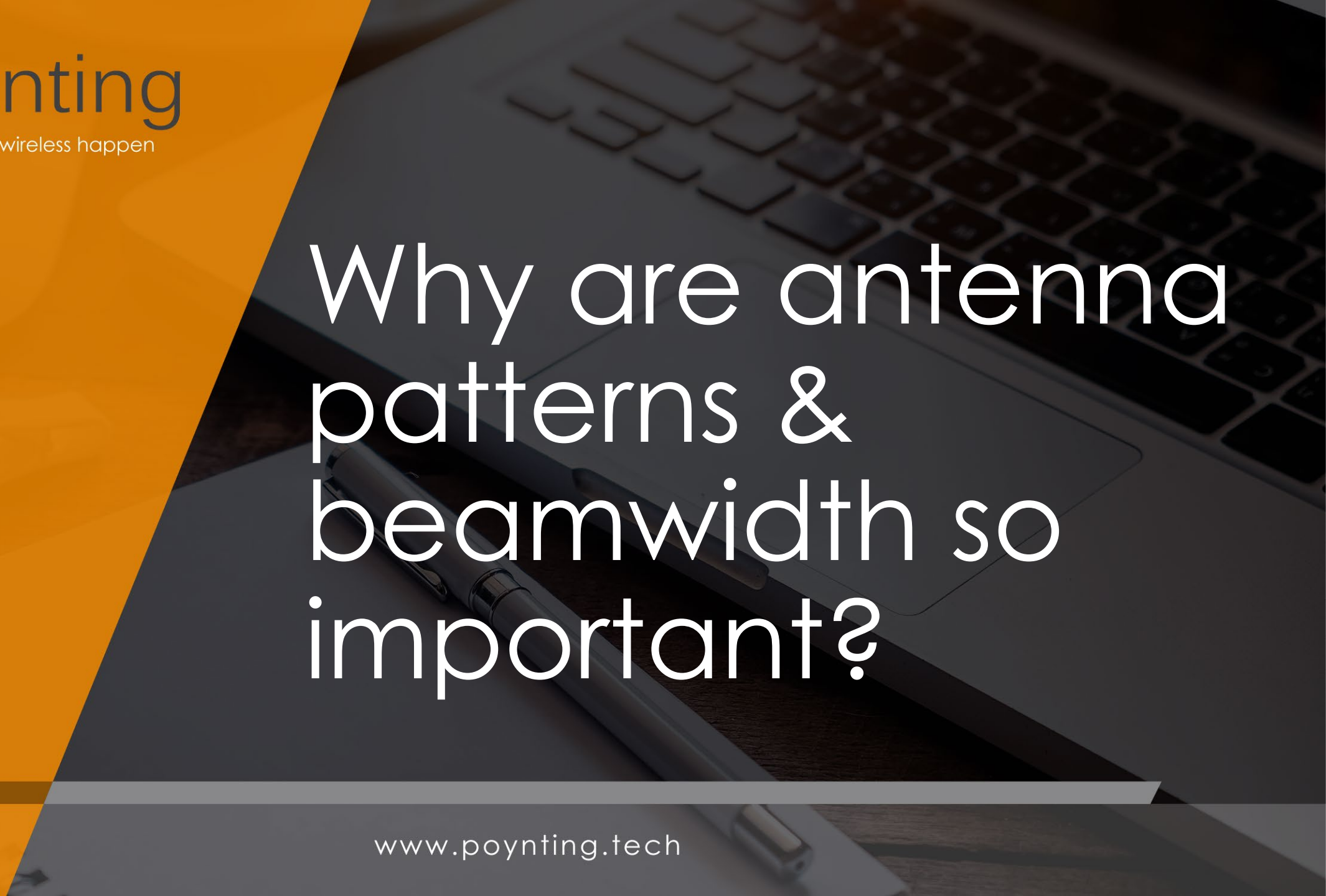
Why are antenna patterns & beamwidth so important?



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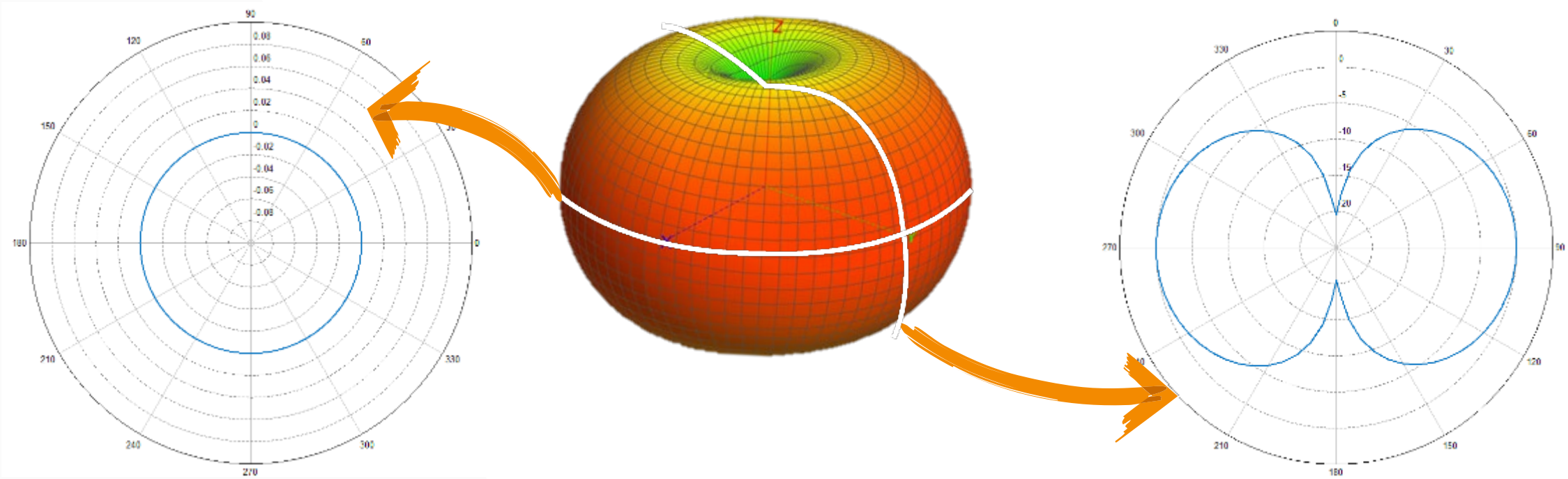
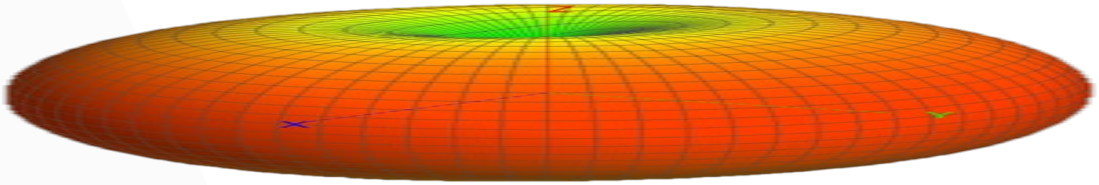
What are antenna radiation patterns?

Example: Low Gain OMNI



Azimuth (Top view)

Elevation (Side view)

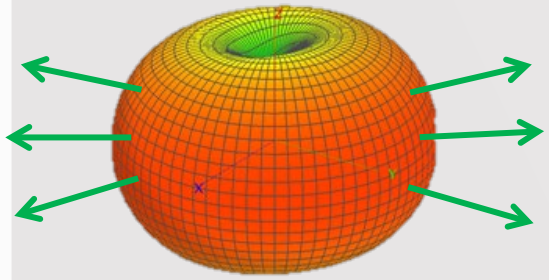


Example: High Gain OMNI

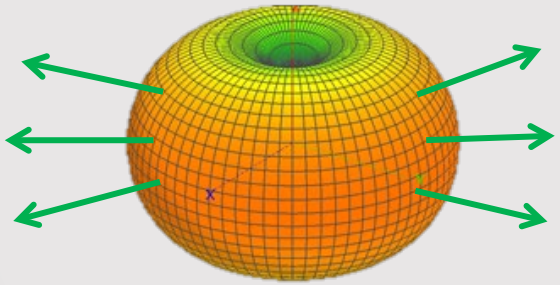
What is antenna pattern performance?

HIGH PERFORMANCE ANTENNAS
(Real Examples: Power radiated in desired direction)

Low Gain Omni Antenna

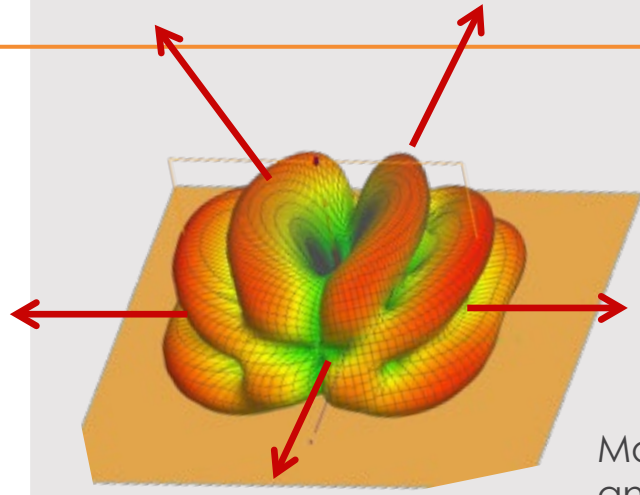


Low Frequency



High Frequency

POOR PERFORMANCE ANTENNA
(Hypothetical Examples)



'Dead spots' on antenna radiation pattern severely impacts performance

Most of the antenna gain is lost, away from the target direction

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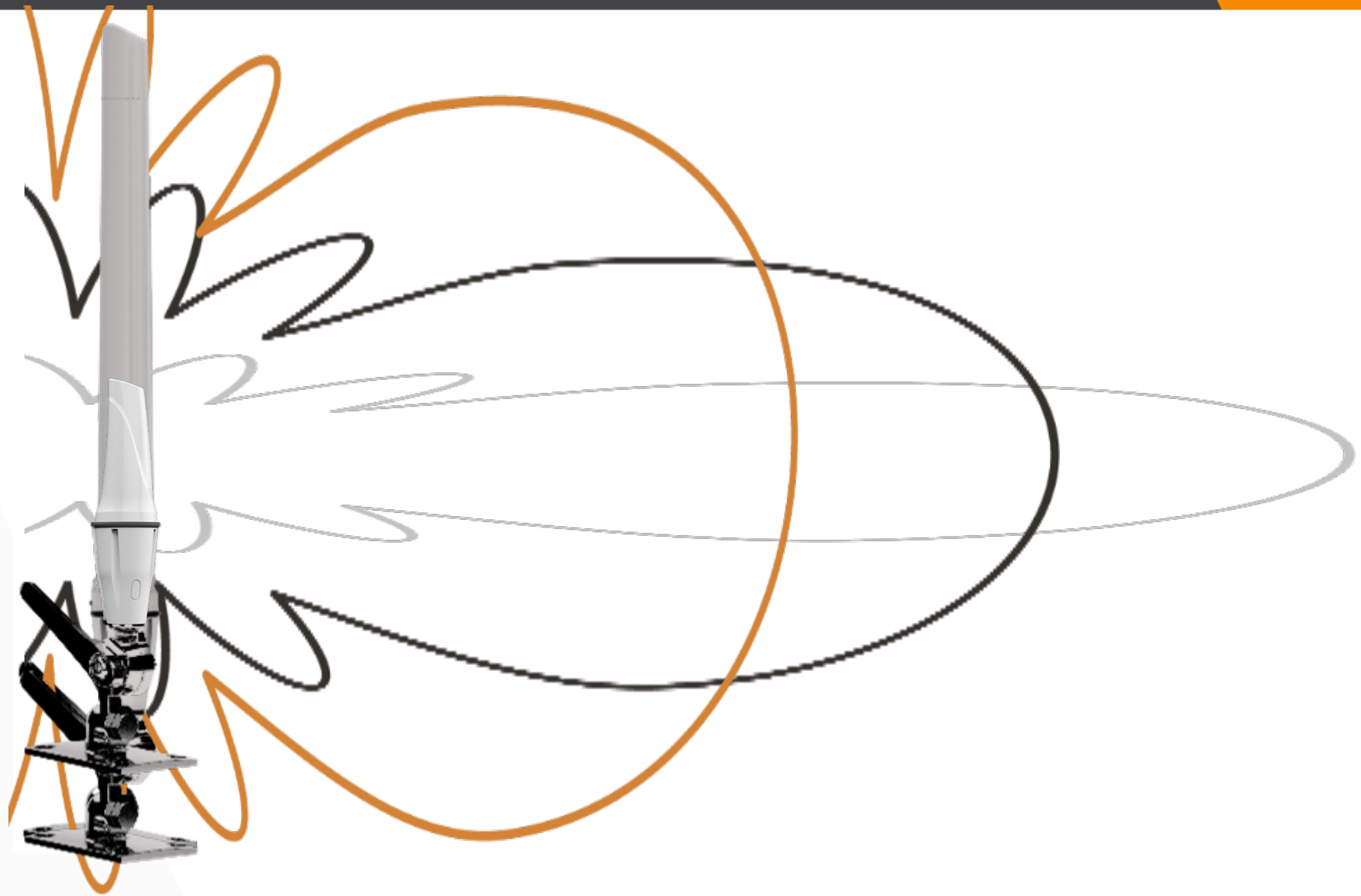
Marine Range: Antenna Size, Beamwidth & Gain



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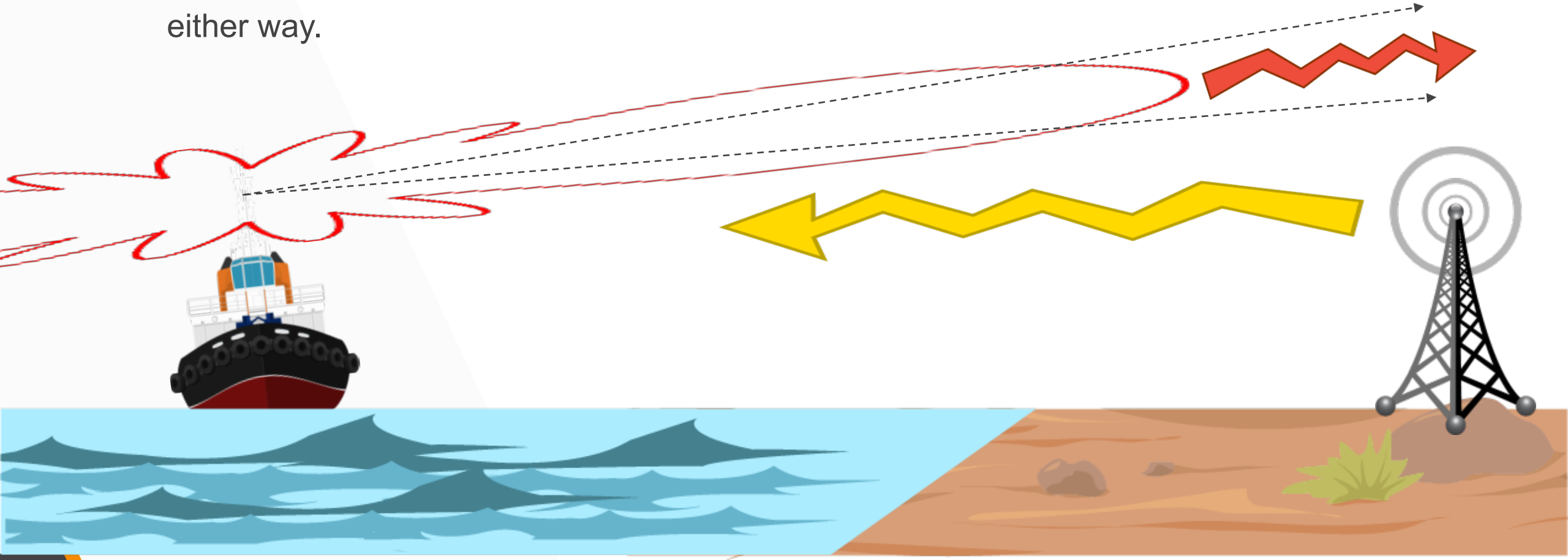
Marine Antennas Impact of High Gain

- A ship rolls to 10° on moderate seas, either way, sometime more (vessel and sea conditions)
- Antenna Gain of 9 dBi => 12° Antenna elevation beam-width => allows for +6° roll and -6° roll either way.



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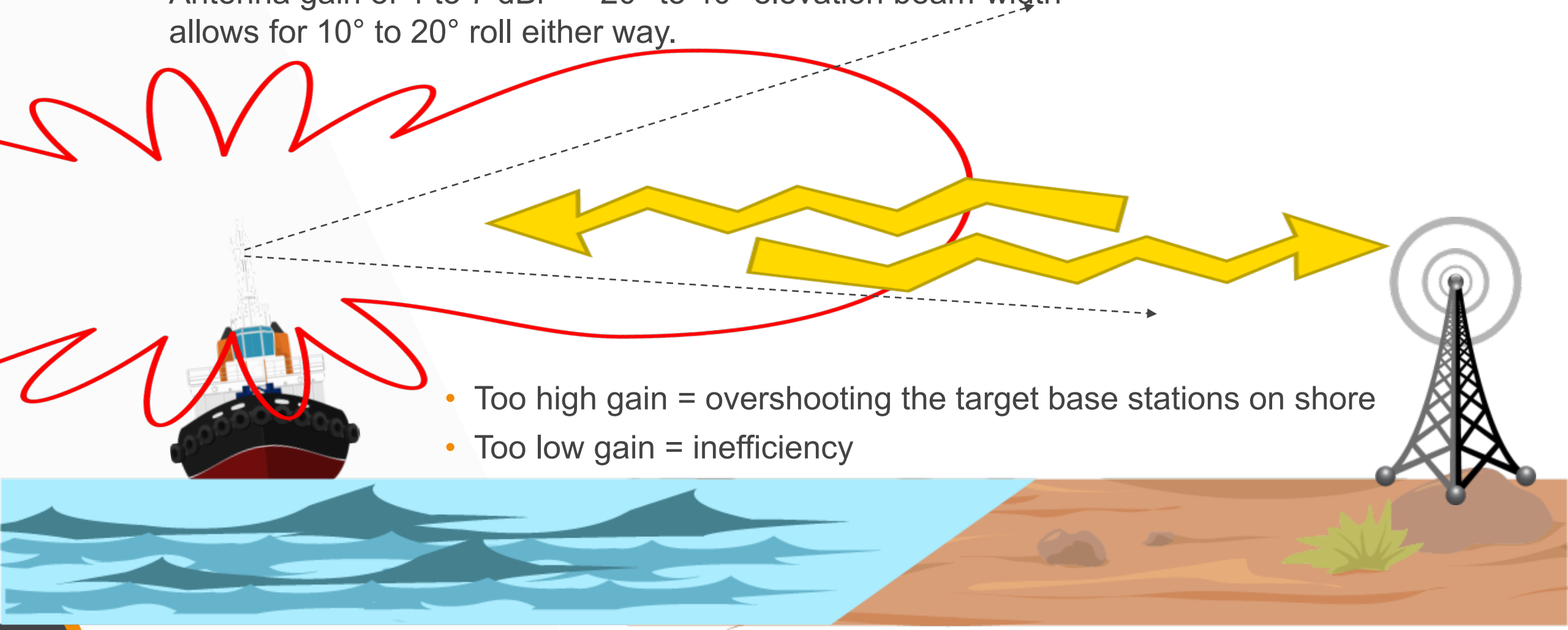
Marine Antennas Impact of Medium Gain

- Antenna gain of 4 to 7 dBi => 20° to 40° elevation beam-width => allows for 10° to 20° roll either way.



- Too high gain = overshooting the target base stations on shore
- Too low gain = inefficiency

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Example of lower antenna gain requirements

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How far apart should the antennas be separated?

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What to consider for antenna spacing?

1. Antenna Isolation
2. Antenna Diversity
3. MIMO Decorrelation

Antenna Spacing = Max of all three

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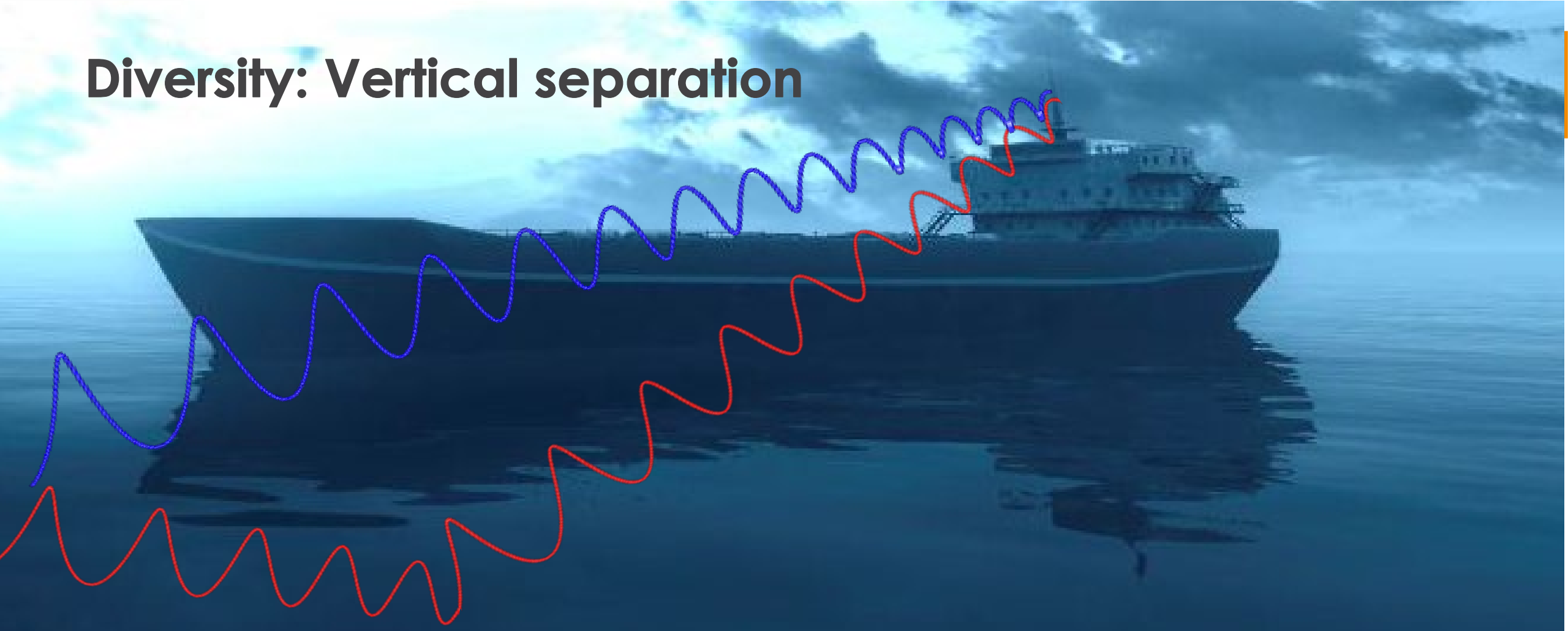
Diversity: Vertical separation



Diversity:
Vertical Separation works better when majority reflections come from below

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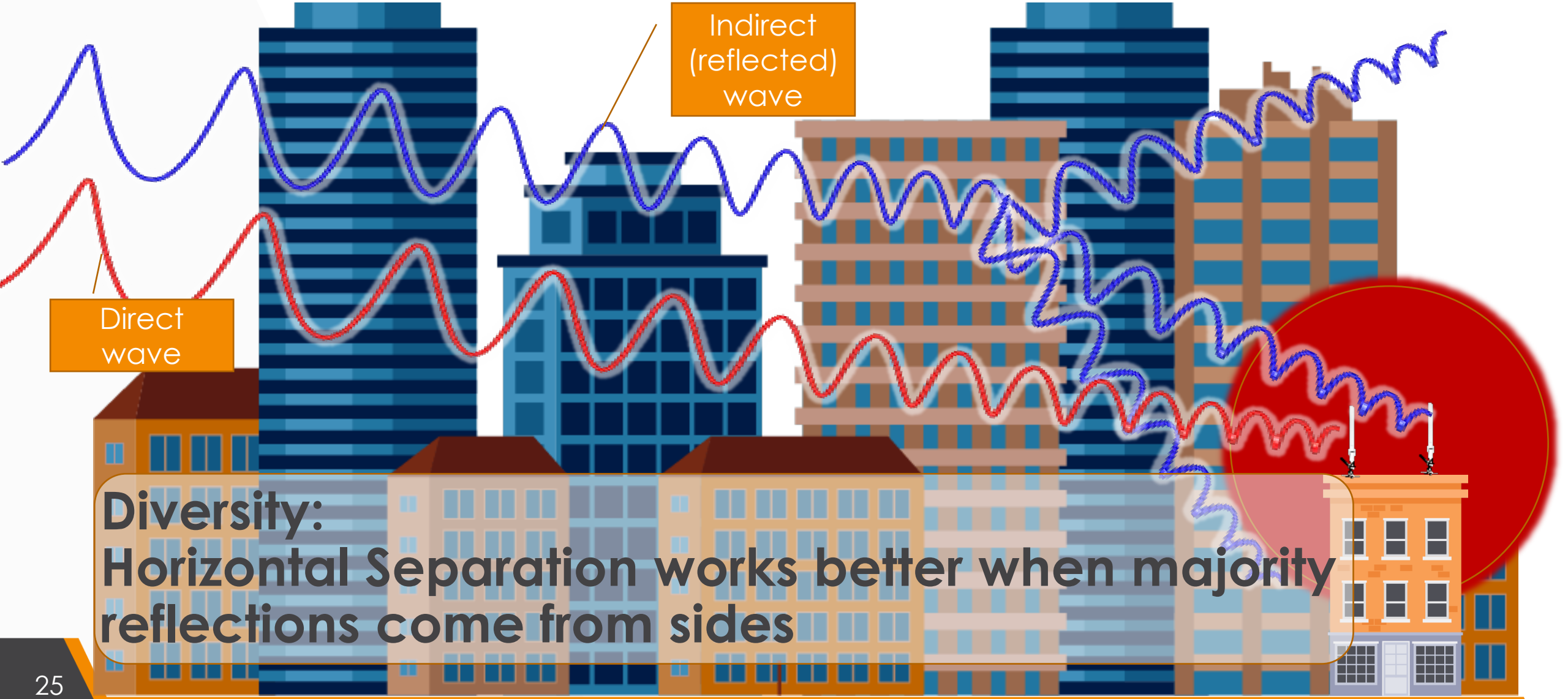
Diversity: Horizontal separation



Diversity:
Horizontal Separation works better when majority reflections come from sides

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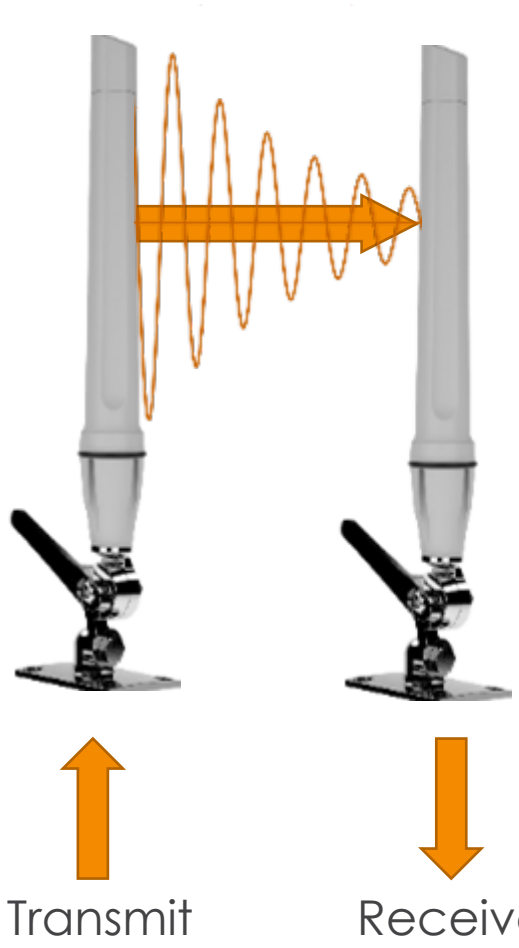
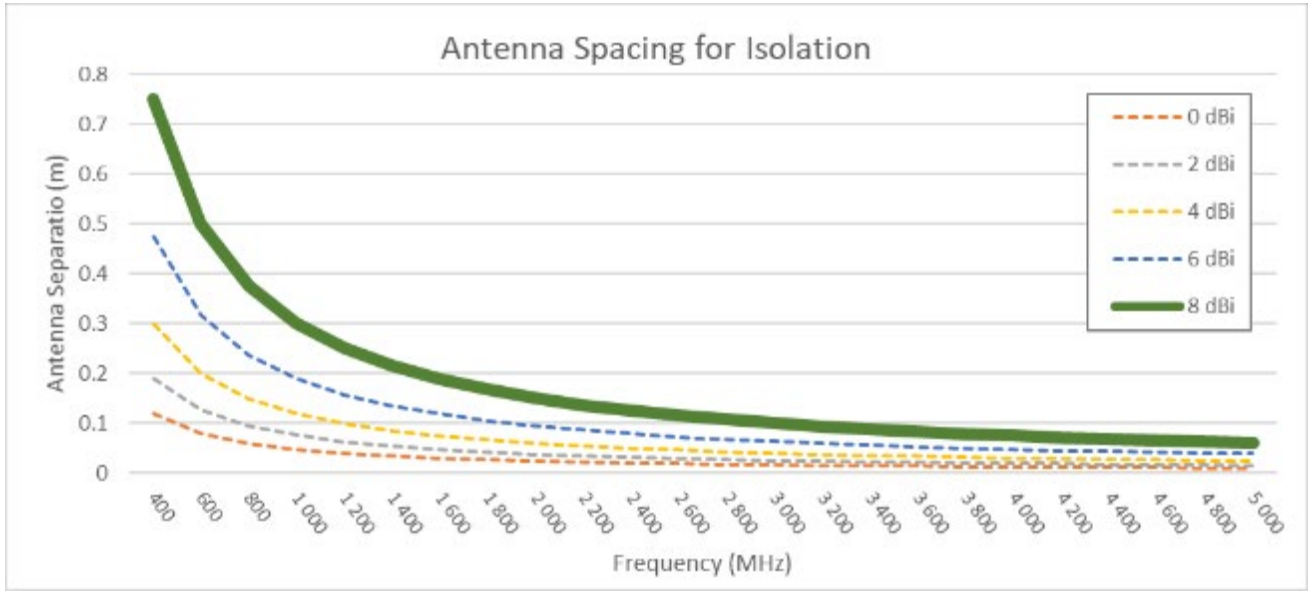
1. How does isolation impact antenna spacing?



Horizontal Spacing (MINIMUM Distances), more = better

- 10dB Isolation between ports (3GPP TS 36.101)
- Isolation (dB) = 2 x (coax loss - antenna gain) + FSL
- Assumption: 2dB Coax Loss



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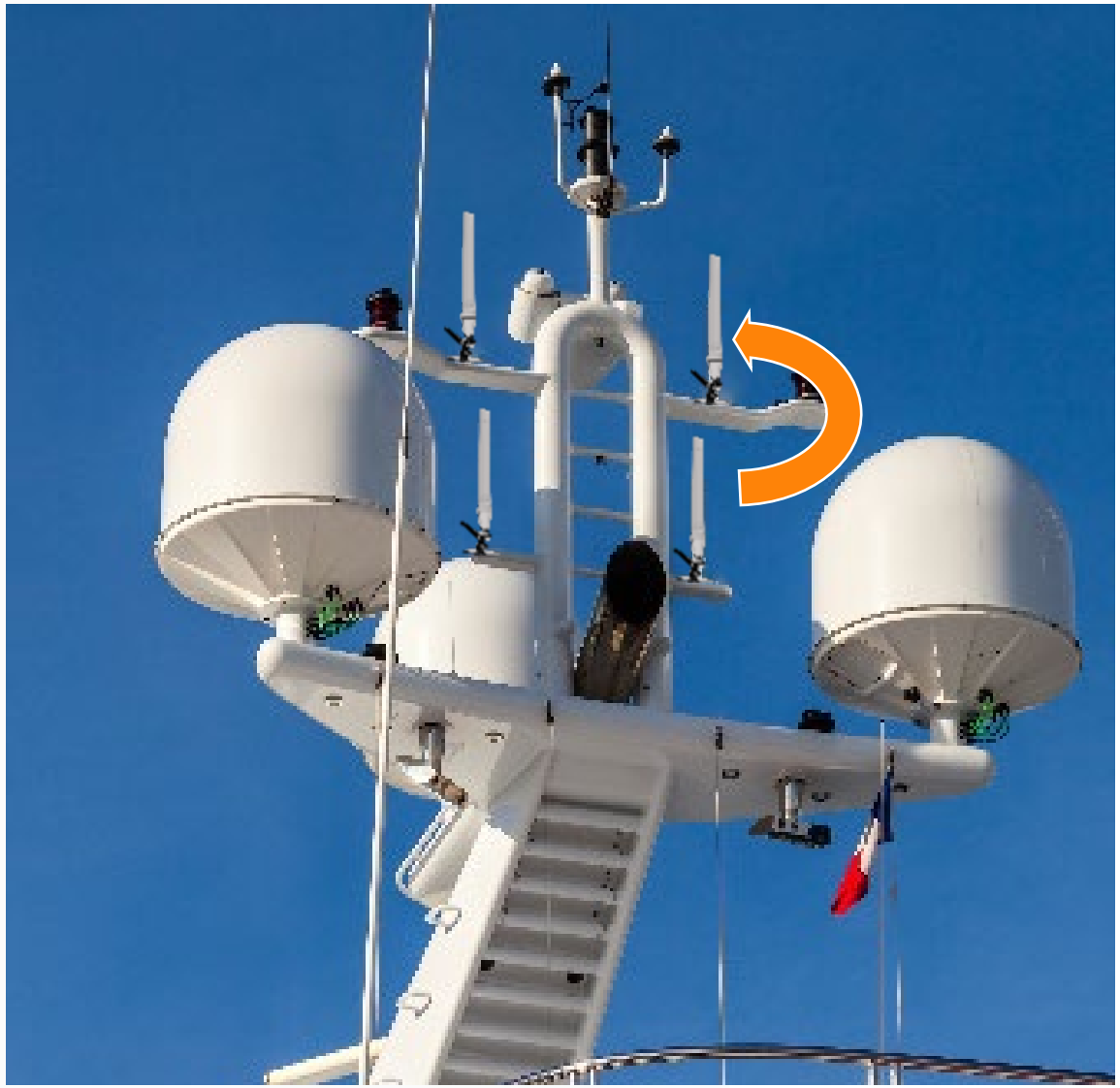
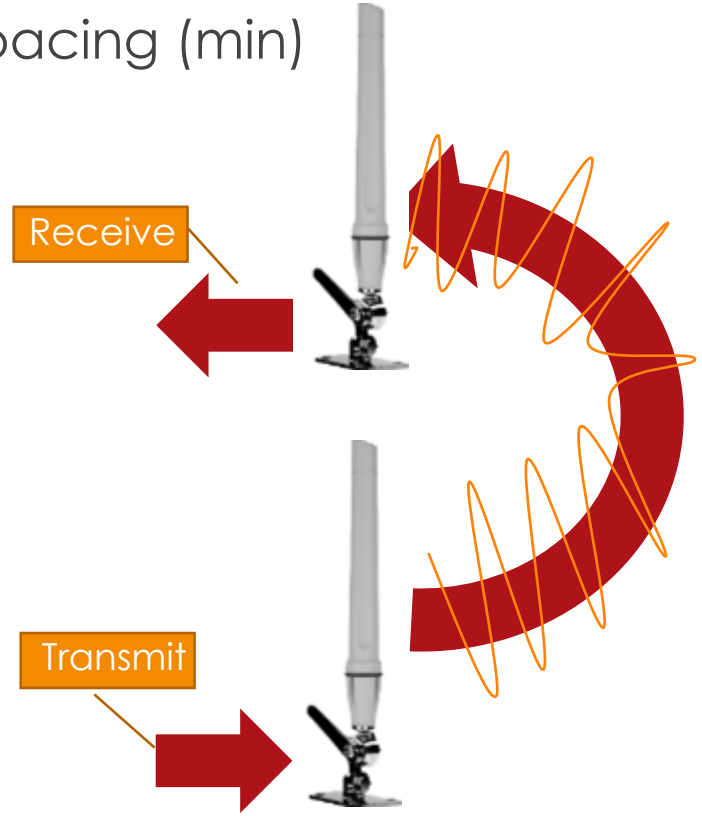
How does isolation impact antenna spacing?



- A good antenna has a vertical (upwards) gain of -20 to -40dB
- Effectively allowing very close installation
- Assume 0.5m spacing (min)



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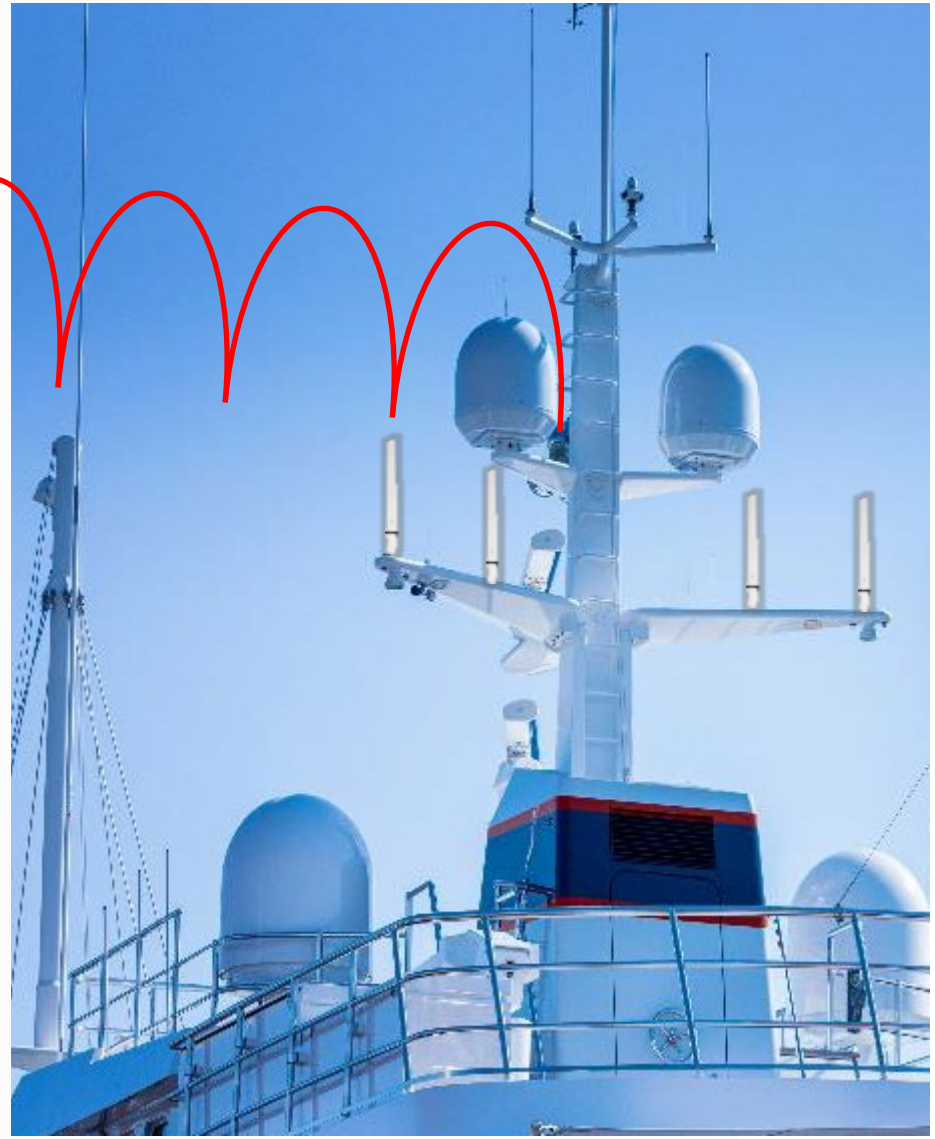
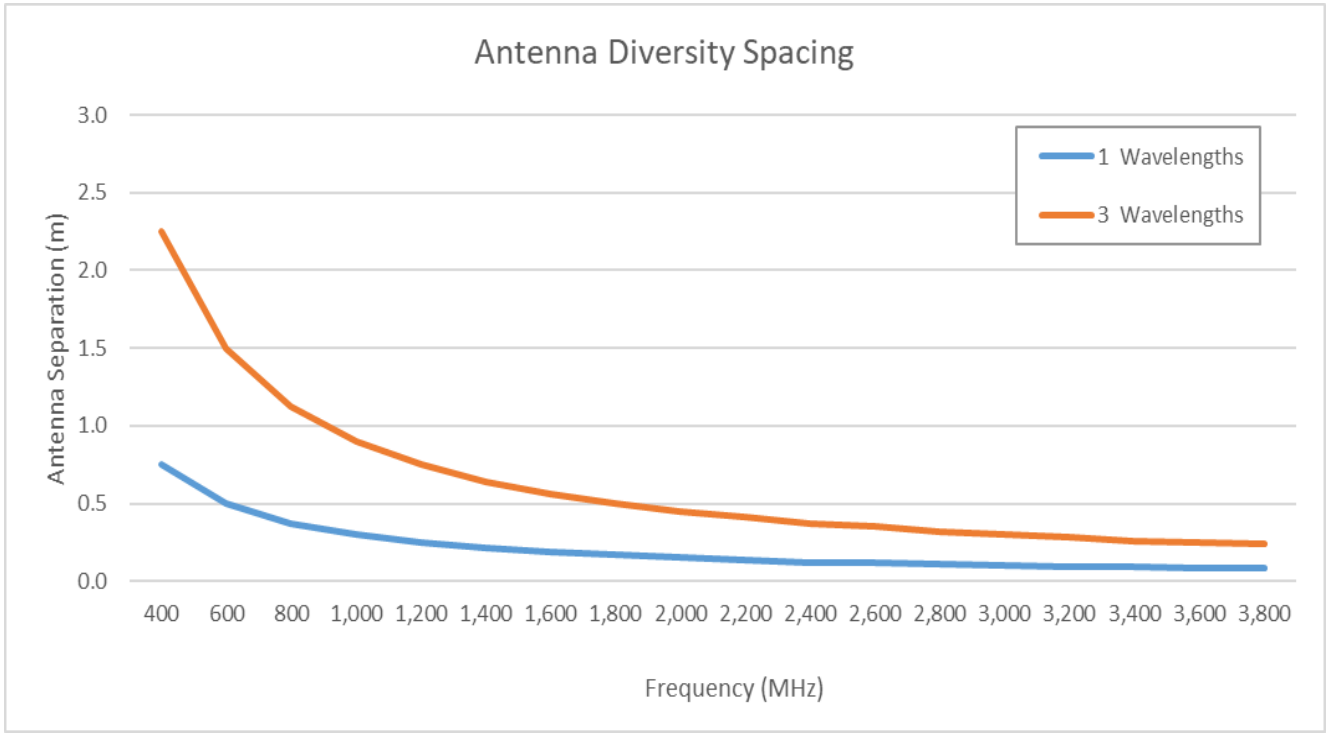
What about 2. Diversity and 3. MIMO?



- Diversity improves the probability of receiving a better signal level (fading)
- MIMO improves the throughput when MIMO signals are decorrelated



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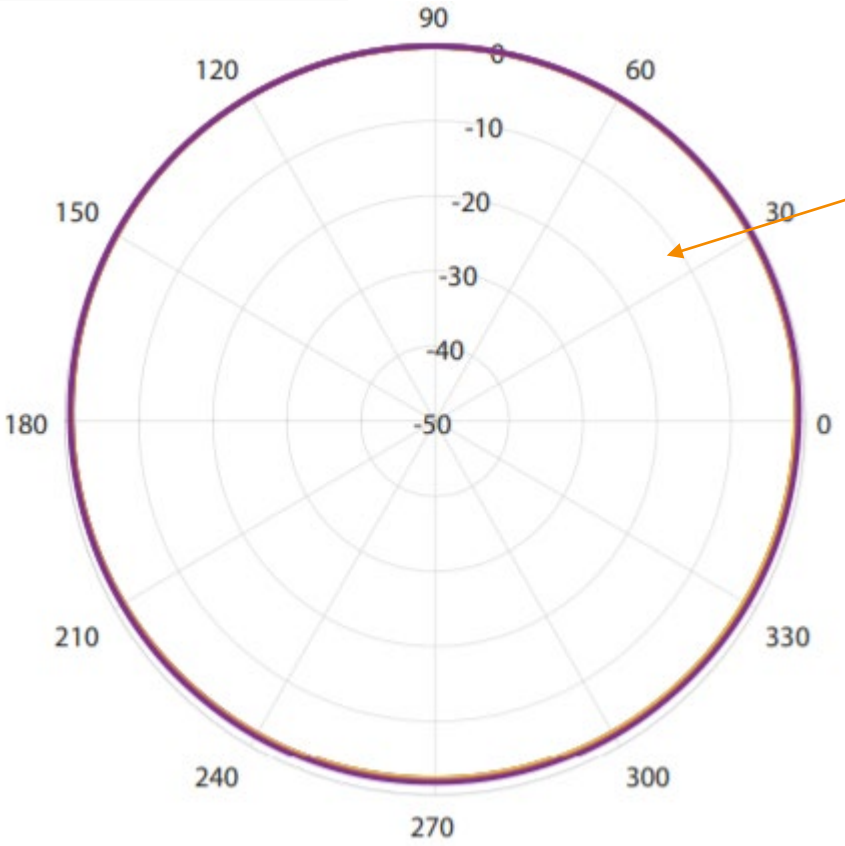
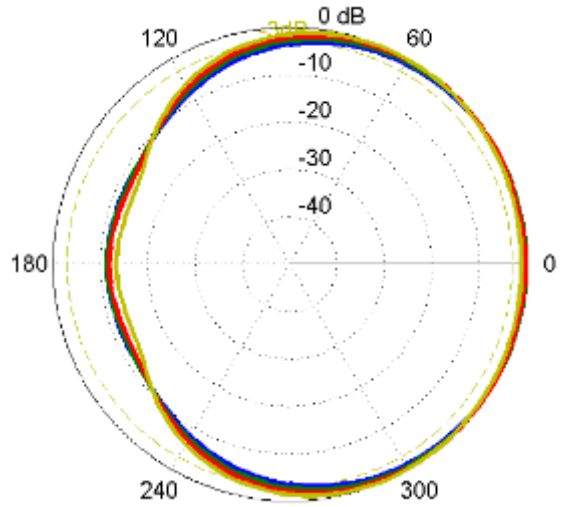
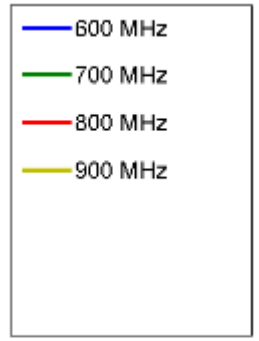
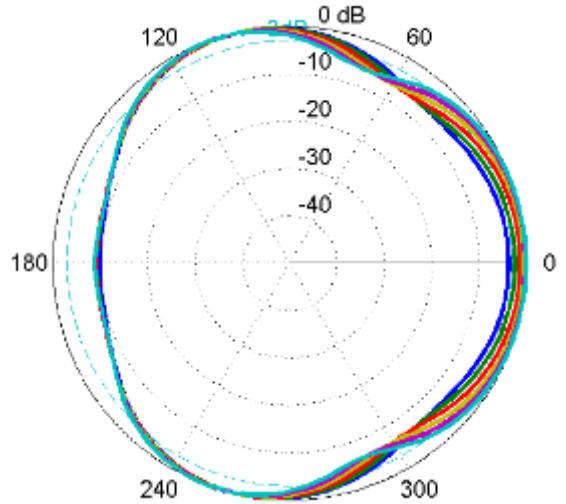
OMNI installation – radiation pattern near mast

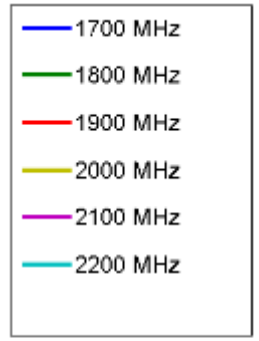


E.g. 110mm









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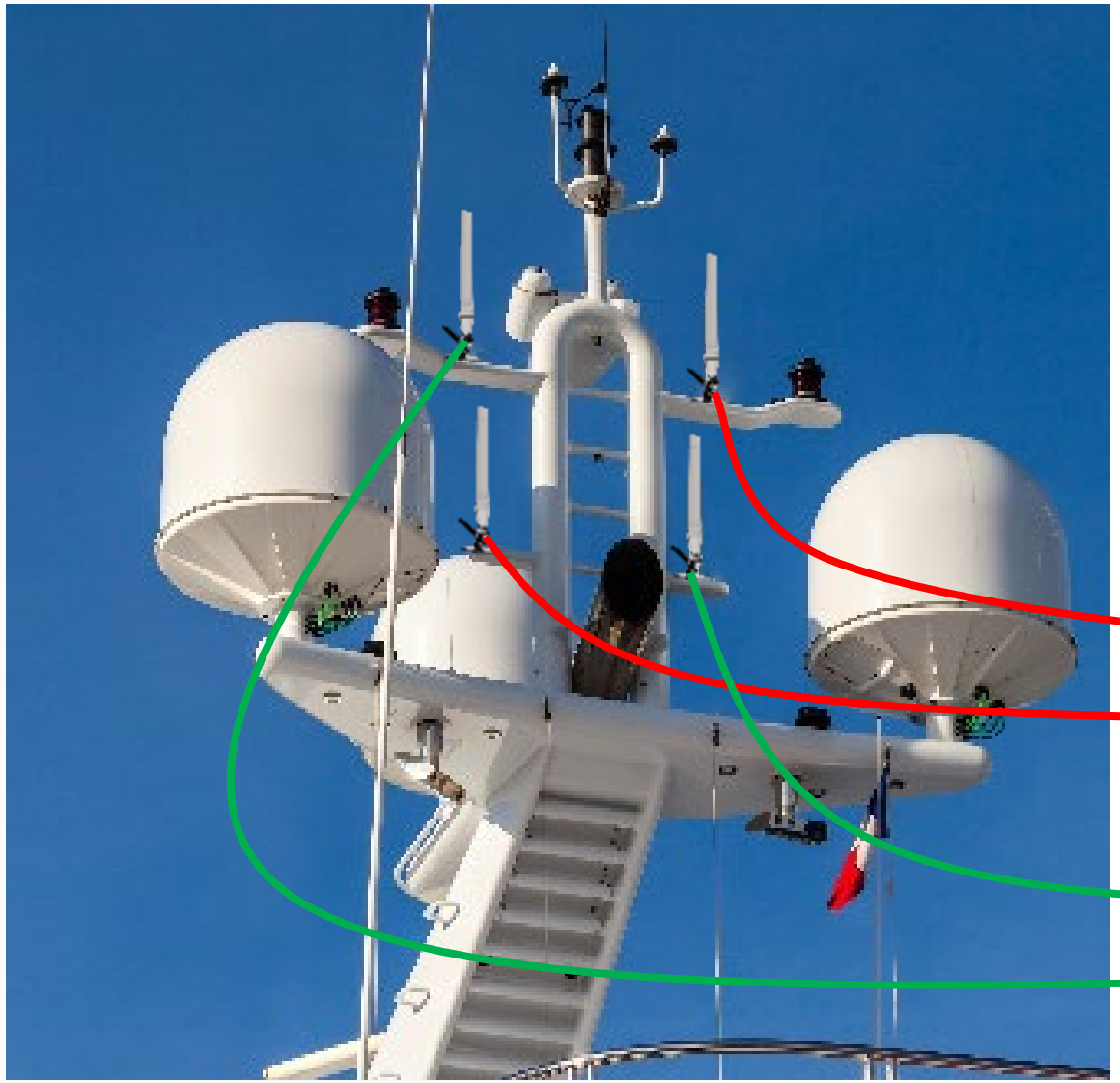
Ideal configuration for Dual 2x2 LTE Router



Example: 4x OMNI-291

2x2 LTE Modem # 1

2x2 LTE Modem # 2

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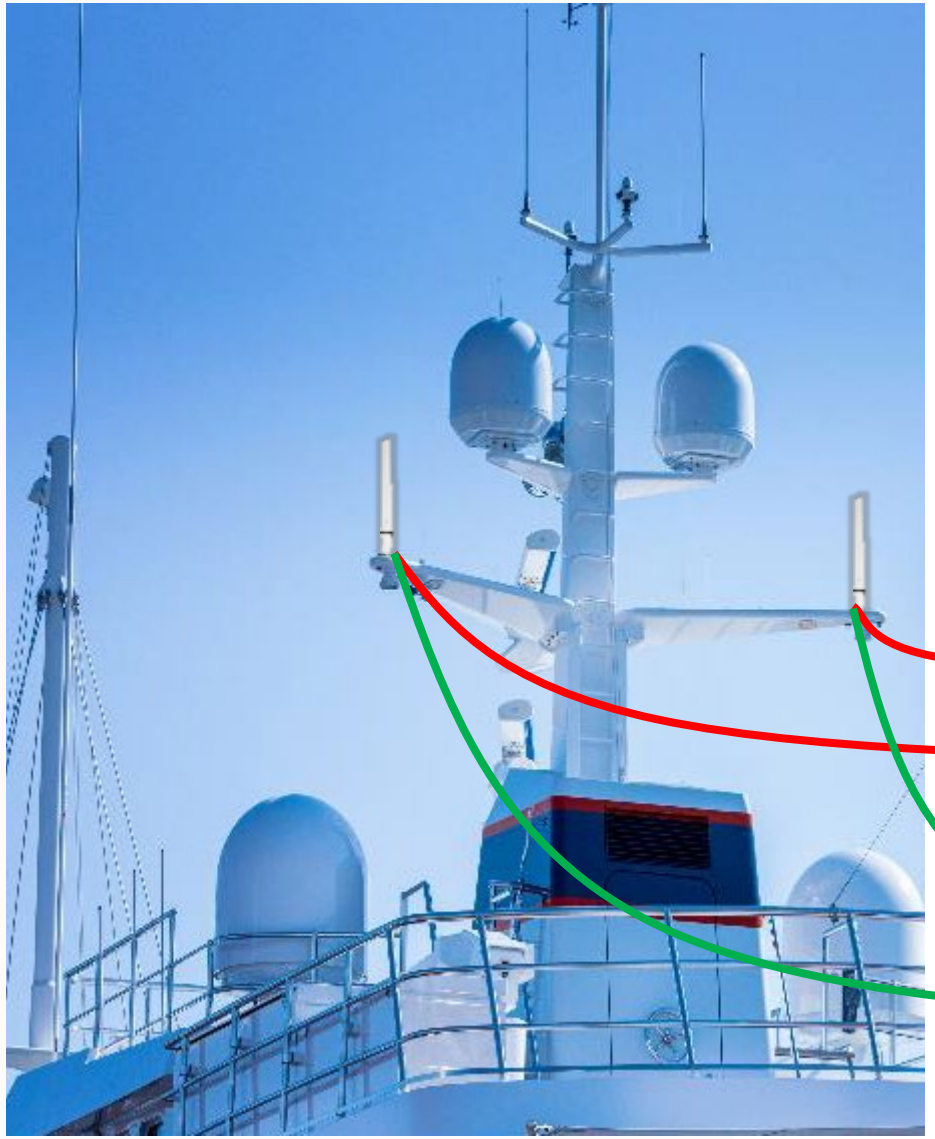
Ideal configuration for Dual 2x2 LTE Router



Example: 2x OMNI-402

2x2 LTE Modem # 1

2x2 LTE Modem # 2

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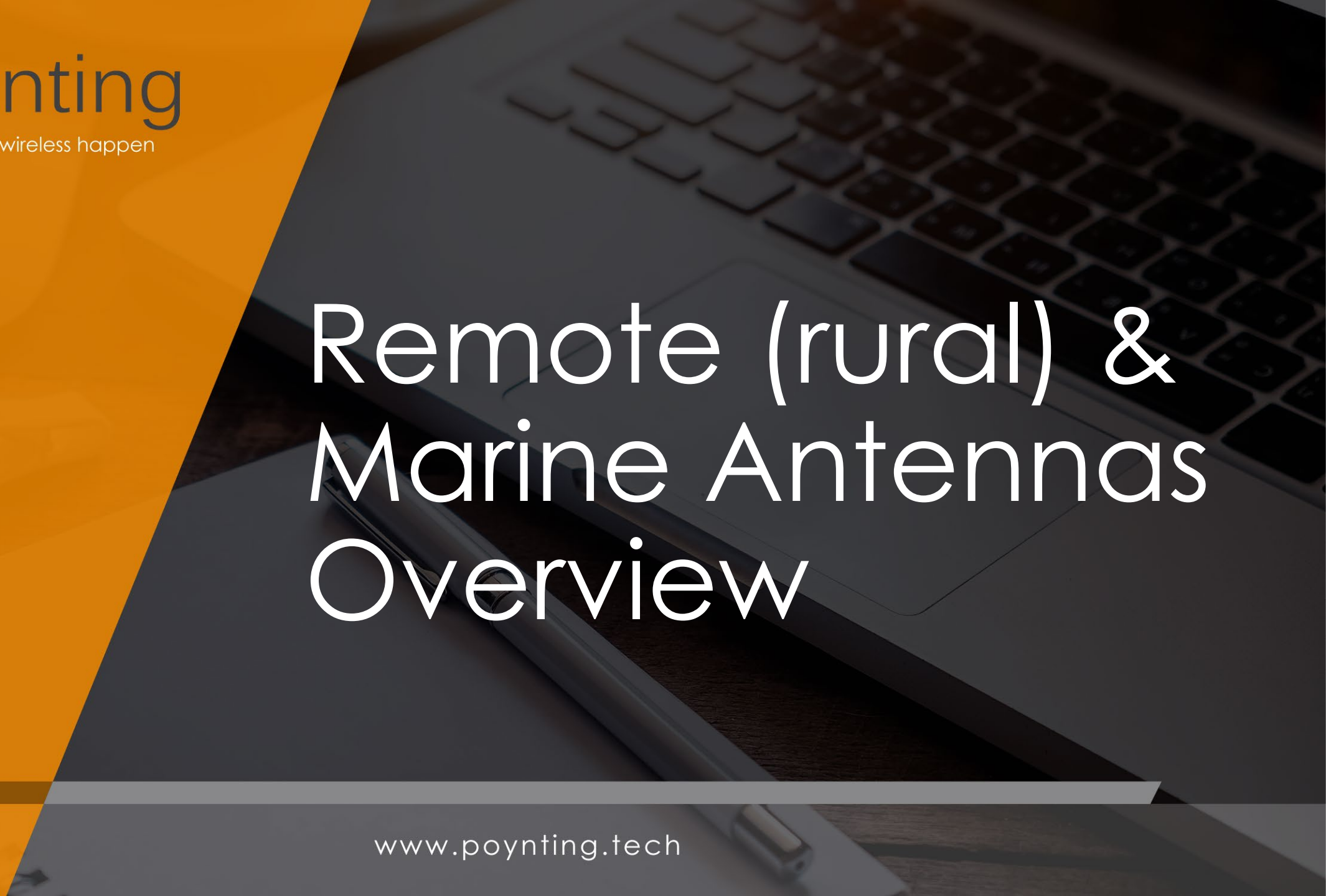
Remote (rural) & Marine Antennas Overview



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Marine Antenna Range: Overview

- SAN Marine ASA plastic enclosure
- UV & Chemical protected
- IK 8 & 10 impact resistance
- Vibration & salt spray protected (MIL-STD 810F/ASTM B117)
- IP68 (submersible) – foam filled
- 316 Stainless Steel screws, mounting plate & marine accessories
- 1” (14 TPI) Marine Adapter included
- Pole Mount L-bracket (Ø30-50mm) included in some models

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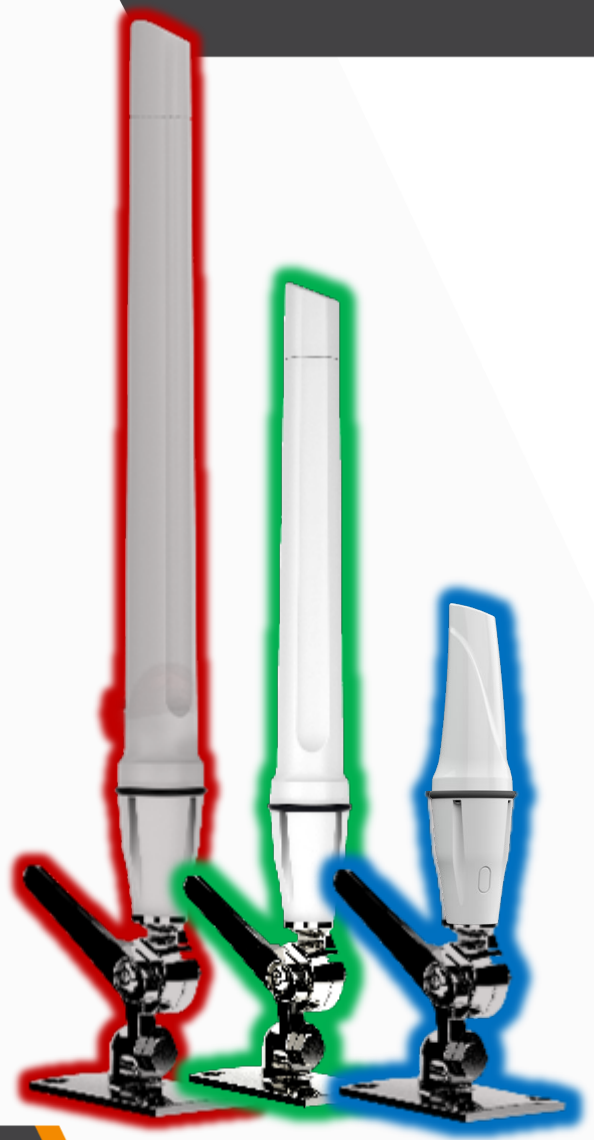
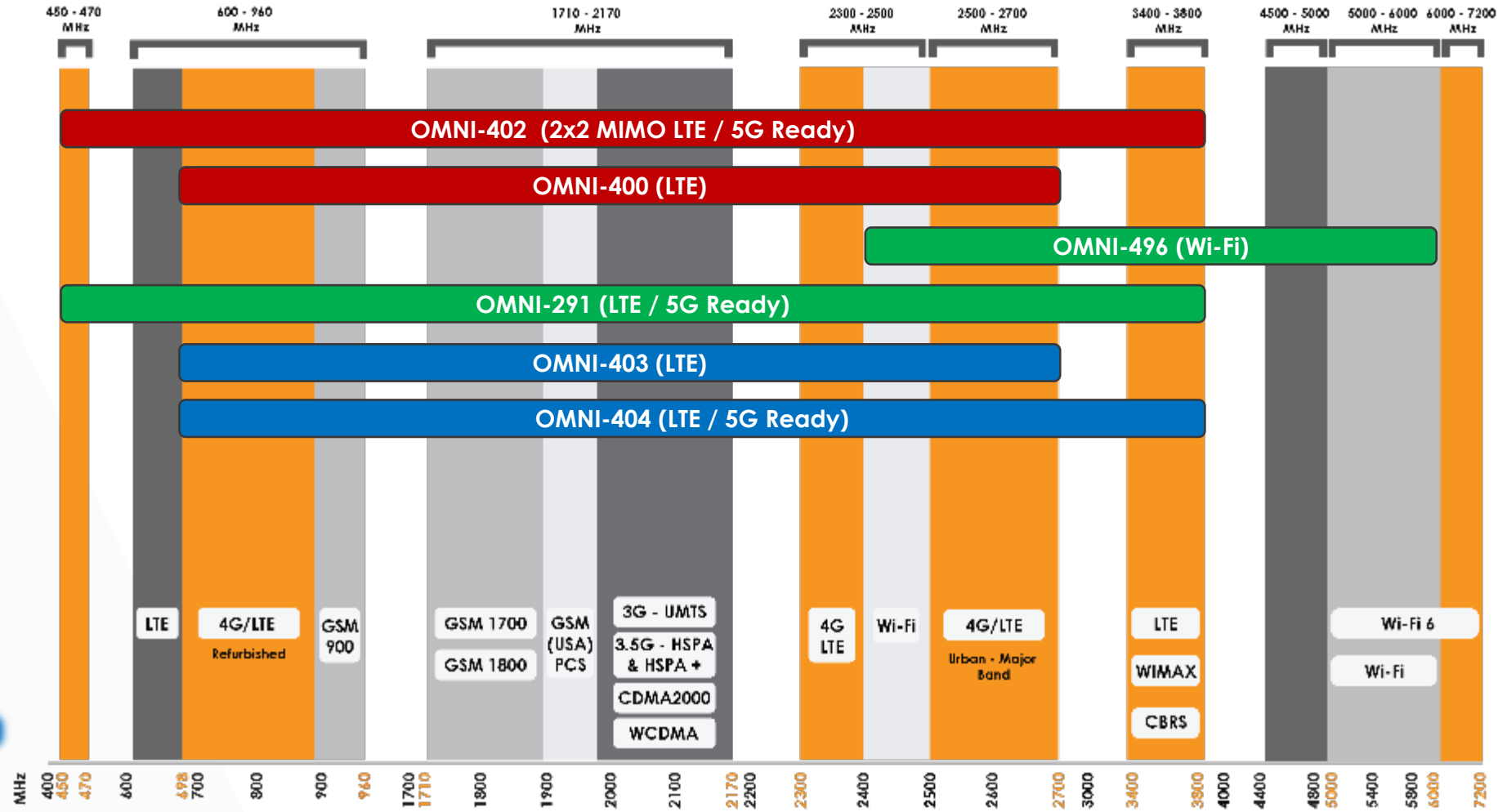
Marine Antenna Range: Overview





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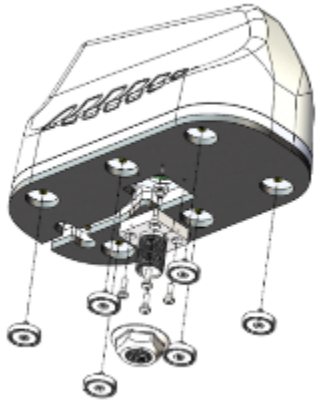
MIMO-3-V2 Series

- Variations of the following:
  - 4x4 MIMO LTE: **410MHz – 3800MHz**
  - 2x2 MIMO Dualband WiFi: **2.4GHz & 5GHz**
  - GPS/GLONASS
- Mounting Options:
  - Removable Spigot (30mm & 80mm lengths)
  - 6x M4 direct/flush mountable
  - Removable Magnet Mounts (Optional)
  - Thicker Foam base (5mm)
- Foam filled (IP68 rating)



4G LTE · 5G READY · Wi Fi DUALBAND · GPS · 4x4 MIMO

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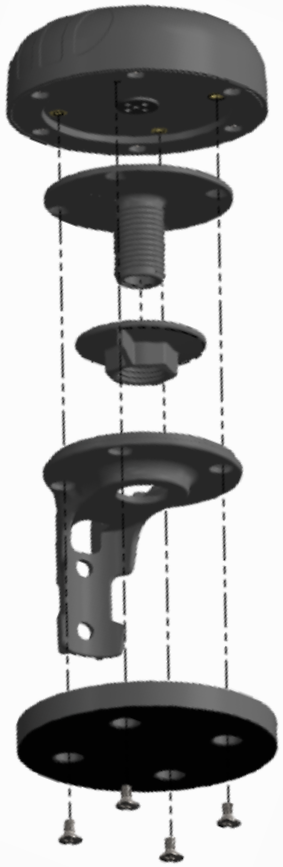
Puck Range of Antennas



- Easy installation; Multi-Mounting options: **Magnetic, spigot, screw, double sided tape & wall/pole bracket (included)**
- Small & Low-Profile (Ø 102mm x h 38mm)
- Waterproof & Dustproof (complies with IP68)
- Highly Ruggedized (complies with IK08)
- Fire Resistant (complies with ECE-R 118.02)

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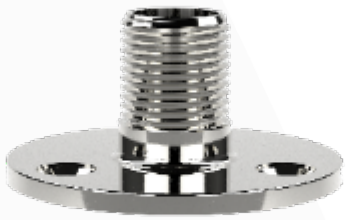
Marine Brackets



- BRKT-37: Flat Mount Marine Bracket
  - Antenna mounting Ø: Standard 1” x 14 TPI (threads per inch)
  - Material: 316 Grade Stainless steel
- BRKT-38: Ratchet Rail Mount Marine Bracket
  - Antenna mounting Ø: Standard 1” x 14 TPI (threads per inch)
  - Material: 316 Grade Stainless steel
  - Mounting pipe Ø: 7/8” to 1”
- BRKT-39: Adjustable Marine Mount Bracket
  - Antenna mounting Ø: Standard 1” x 14 TPI (threads per inch)
  - Material: 316 Grade Stainless steel

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Making wireless happen

Thank you!

Any questions?

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